

# 106 Investigating Natural Structures



**Y**ou built lightweight, strong bone prototypes in Activity 105, “Designing Artificial Bones,” but there may be design possibilities that you didn’t even consider. One way bioengineers approach problems like this is to observe the structures of body parts that perform similar functions in organisms. By dissecting a chicken wing, you can find out how bird bones can be both lightweight and strong. In this activity, you will also study how the parts of the chicken wing move. This will help you think about how you could design an artificial arm that works in a similar way.

## CHALLENGE



How does the structure of an arm or wing affect its function?



## MATERIALS



*For each pair of students*

- 1 chicken wing
- 1 pair of pointed, medium or large dissection scissors
- 2 pairs of forceps
- 1 tray
- paper towels
- 1 toothpick
- 1 hand lens (optional)



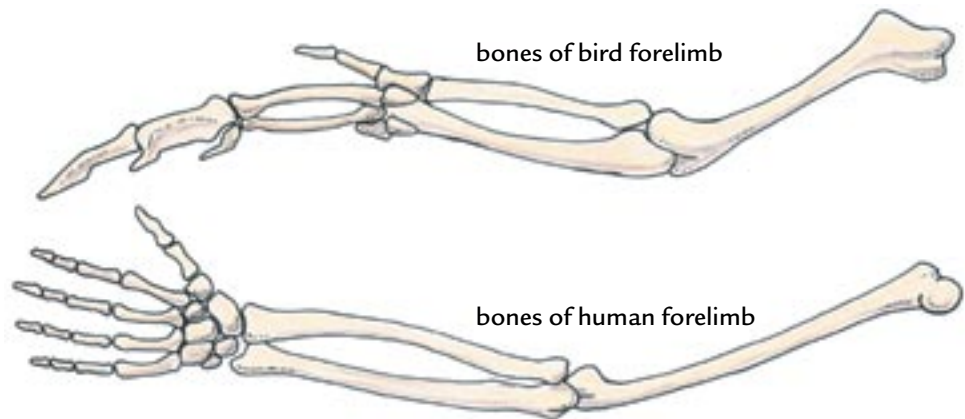
### SAFETY

Only one person may dissect at a time—take turns. Keep your fingers out of the way of sharp implements. Do not eat or drink in class. Be very careful not to touch your mouth, nose, or eyes when you are working on the dissection. Wash your hands thoroughly with soap and hot water after completing the dissection.

## PROCEDURE

### Part A: Comparing the Chicken Wing to the Human Arm

1. Locate the following structures in your arm: shoulder, elbow, and wrist joints; two forearm bones, one upper arm bone, thumb and finger bones.
2. Examine the whole chicken wing.
3. Without cutting yet, feel the wing. Use your fingers to find structures on the chicken wing that are similar to the human arm structures listed in Step 1.



### Part B: Comparing the Movement of Wings and Arms

4. Turn the wing so the inside is facing up. Use your forceps to pinch up the skin, and make a small cut with your scissors, as shown in Step A.



*Step A: Making a cut.  
Make a small cut in the skin.*



*Step B: Inserting the scissors. Insert the tip of the scissors into the small cut.*



*Step C: Cutting the skin. Cut the skin along the bone, without cutting the muscle.*



*Step D: Pulling the tendon. Use your forceps to pull on the tendon.*



*Step E: Moving the chicken wing. Observe the chicken's "hand" moving toward the lower "arm."*

5. As shown in Step B, insert a scissor blade into the cut so that it is parallel to the bones. Be careful that you don't cut through muscle under the skin.

6. As shown in Step C, cut the skin, and peel it away from the muscle, using your forceps and scissors to help you. Expose both major joints of the chicken wing.

Observe the tendons, blood vessels, and muscle. Tendons are the shiny strips of tissue that connect muscles to bones.

7. Use your forceps to pull on tendons individually. When muscles contract, they pull on tendons, so when you pull on a tendon, you are modeling the action of a wing muscle (Steps D and E ).

Try to get a part of your chicken wing to "wave" back and forth by pulling on tendons attached to two opposing muscles.

8. Cut through the muscles until one of the chicken's lower wing bones is clearly visible.

9. Break the bone with your fingers. Notice how resistant the bone was to bending.

10. Examine the inside of the chicken bone. Use a toothpick to explore the texture of the center of the bone, the marrow.

11. Set the chicken wing out on the tray so that you can see all of the structures.

12. Wash your hands thoroughly with soap and hot water. Don't touch the chicken after you wash.

13. In your science notebook, draw a labeled diagram of the chicken wing. Include the tendons and the structures you located in Step 6.

14. In your notebook, describe what you had to do to make the wing move in opposite directions. Record your observations of the inside of the chicken bone.

15. Follow your teacher's directions for disposing of the chicken wing and for final clean up.

## ANALYSIS



1. How are human arms and chicken wings similar? How are they different?
2. What evidence did you find that would help to explain how birds move parts of their wings back and forth? Draw a diagram showing muscles and tendons to help explain your answer.
3. Describe how the structure of bird bones allows them to be both light-weight and strong. Use a diagram to help explain your answer.
4. Now that you know the internal structures of bird bones, would you change your bone prototype from Activity 105? If so, describe how and why. If not, explain why not.